

國立中正大學

110 學年度碩士班招生考試

試題

[第3節]

科目名稱	生物化學
系所組別	生物醫學科學系生物醫學

—作答注意事項—

※作答前請先核對「試題」、「試卷」與「准考證」之系所組別、科目名稱是否相符。

1. 預備鈴響時即可入場，但至考試開始鈴響前，不得翻閱試題，並不得書寫、畫記、作答。
2. 考試開始鈴響時，即可開始作答；考試結束鈴響畢，應即停止作答。
3. 入場後於考試開始 40 分鐘內不得離場。
4. 全部答題均須在試卷（答案卷）作答區內完成。
5. 試卷作答限用藍色或黑色筆（含鉛筆）書寫。
6. 試題須隨試卷繳還。

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請將答案依序寫在非選擇題作答區

1. (a) glycine (b) threonine (c) methionine
(d) lysine (e) cysteine (f) aspartic acid
(g) glutamic acid (h) leucine (i) isoleucine
(j) proline (k) valine (l) glutamine

Which of the above matches the description below?

- (1) _____ does not contain the chiral center (1%)
(2) _____, (3) _____ contains two chiral centers (2%)
(4) _____ positive charge at pH 7.0 (1%)
(5) _____ side-chain contains a hydroxyl group (1%)

2. Match the following molecules with their biological roles.

- (a) glycogen (b) starch (c) chitin (d) cellulose (e) peptidoglycan
(f) hyaluronate (g) proteoglycan (h) lipopolysaccharides

- (1) _____ viscosity, lubrication of the extracellular secretions (1%)
(2) _____ carbohydrate storage in plants (1%)
(3) _____ exoskeleton of insects (1%)
(4) _____ structural component of bacterial cell wall (1%)
(5) _____ structural component of plant cell walls (1%)
(6) _____ extracellular matrix of animal tissues (1%)
(7) _____ carbohydrate storage in animal liver (1%)
(8) _____ The molecules are prime targets of the antibodies produced by the vertebrate immune system in response to bacterial infection (1%)

3. (A) Competitive inhibitor

(B) Noncompetitive inhibitor

(C) Uncompetitive inhibitor

Which of the inhibitors above is described by the statement below?

- (1) _____ often structurally related to the substrate or product (1%)
(2) _____ lowers V_{max} and enhances the apparent binding of substrate to the enzyme (1%)
(3) _____ increases the apparent K_m (1%)
(4) _____ has no effect on the apparent K_m of the substrate (1%)
(5) _____ only binds to enzyme-substrate complex (1%)
(6) _____ has no effect on the V_{max} (1%)
(7) _____ occupies the same site with the substrate (1%)
(8) _____ can bind to the enzyme or to the enzyme-substrate complex (1%)

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4. (A) Oxygenated state (B) Deoxygenated state

Which of the above matches the state of normal adult hemoglobin described below?

- (1) _____ β -chains are closer together (1%)
- (2) _____ contains salt bridges involving α -NH₃⁺ groups (1%)
- (3) _____ heme iron is in the plane of the porphyrin ring (1%)
- (4) _____ has a stronger affinity for carbon dioxide (1%)
- (5) _____ stabilized by increased pH (1%)

5. Classify the following fatty acids as ω -3, ω -6, or neither.

- (a) α -linolenate _____ (1%)
- (b) linoleate _____ (1%)
- (c) γ -linolenate _____ (1%)
- (d) arachidonate _____ (1%)
- (e) oleate _____ (1%)
- (f) $\Delta^{8,11,14}$ -eicosatrienoate _____ (1%)

6. Indicate whether each of the following pairs of sugars consists of anomers, epimers, or an aldose-ketose pair:

- (a) D-glyceraldehyde and dihydroxyacetone (1%)
- (b) D-glucose and D-mannose (1%)
- (c) α -D-glucose and β -D-glucose (1%)
- (d) D-glucuronic acid and L-iduronic acid (1%)

7. Why must the DNA polymerase used in the polymerase chain reaction (PCR) be heat stable? (4%)

8. Draw the resonance structure of a peptide bond, and explain why there is no rotation around the C-N bond (peptide bond). (6%)

9. The polar compounds are generally unable to diffuse across biological membranes without the aid of a specific transport system. Why? (5%)

10. How does insulin affect the glucose absorption by skeletal muscle and adipocytes? (5%)

11. The main function of the pentose phosphate pathway. (6%)

12. Calculate the number of ATP molecules obtained from the anaerobic conversion of each of the following compounds to lactate:

- (a) glycerol (2%) (b) fructose (2%) (c) glucose (2%)

13. What sequences are required in an expression vector (for use with *E. coli*), but are not essential in a cloning plasmid? (6%)

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14. Describe the biochemical function of the following enzymes used in recombinant DNA technology.
 - (a) restriction enzymes (2%)
 - (b) DNA ligase (2%)
 - (c) reverse transcriptase (2%)
 - (d) DNA polymerase I (2%)
15. Describe how to transport acetyl groups from mitochondria matrix to cytosol. (6%)
16. Animals cannot carry out a net conversion of even chain fatty acid carbons to glucose. On the other hand, some of the carbons in odd-chain fatty acids can be used for biosynthesis of glucose. Why? (6%)
17. How do the hormones (insulin and glucagon) regulate the glycolysis and gluconeogenesis? (6%)